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Kim et al.

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(54) **LIGHTING DEVICE, BACKLIGHT UNIT, AND PRINTED CIRCUIT BOARD THEREOF**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
F21V 21/00 (2006.01)

(52) **U.S. Cl.** **362/249.02**; 362/97.3; 362/631

(58) **Field of Classification Search** 362/249.02, 362/97.1–97.4, 630, 631, 800, 249.01, 249.03–249.06; 439/56, 61, 62

See application file for complete search history.

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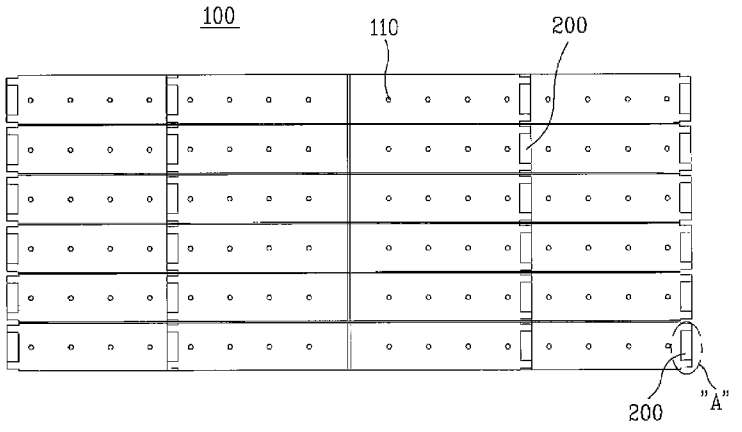
(57) **ABSTRACT**

A backlight unit including a circuit board mounted with light emitting diodes and formed with connecting pads electrically connected with the light emitting diodes, a driver installed on one surface of the circuit board and configured to drive the light emitting diodes, a connector coupled to the connecting pads of the circuit board, in which the connector has a connecting direction changed toward the driver, and a connecting line for connecting the connector to the driver.

22 Claims, 9 Drawing Sheets



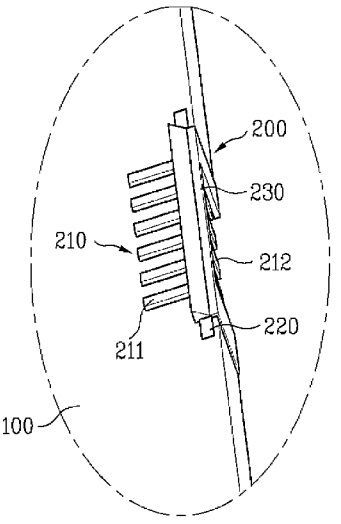


FIG. 1
Related Art

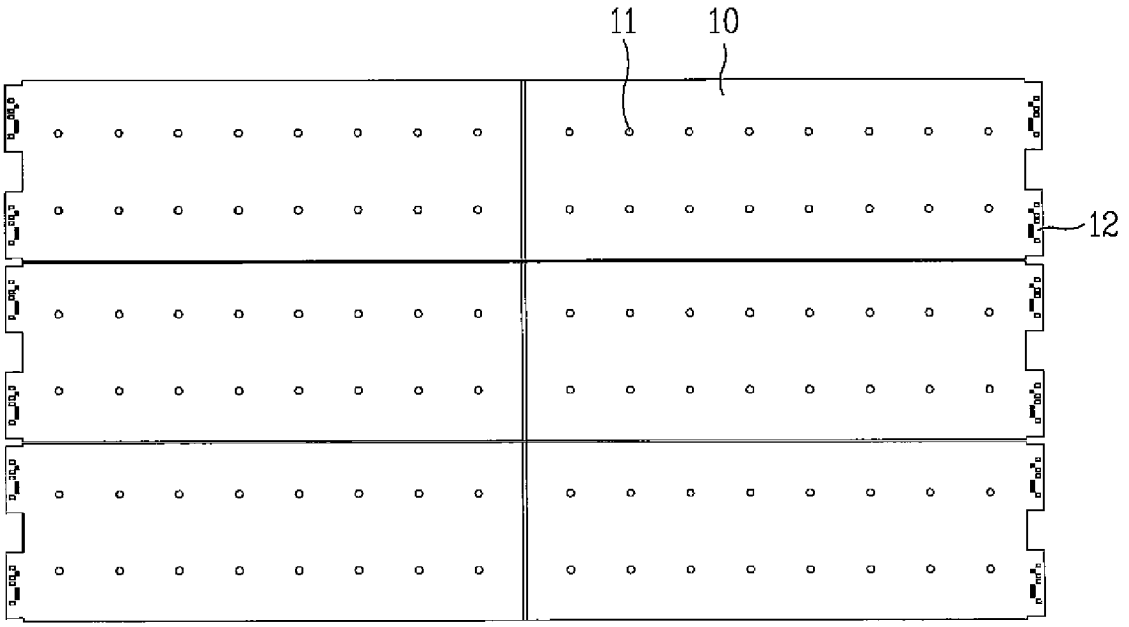


FIG. 2
Related Art

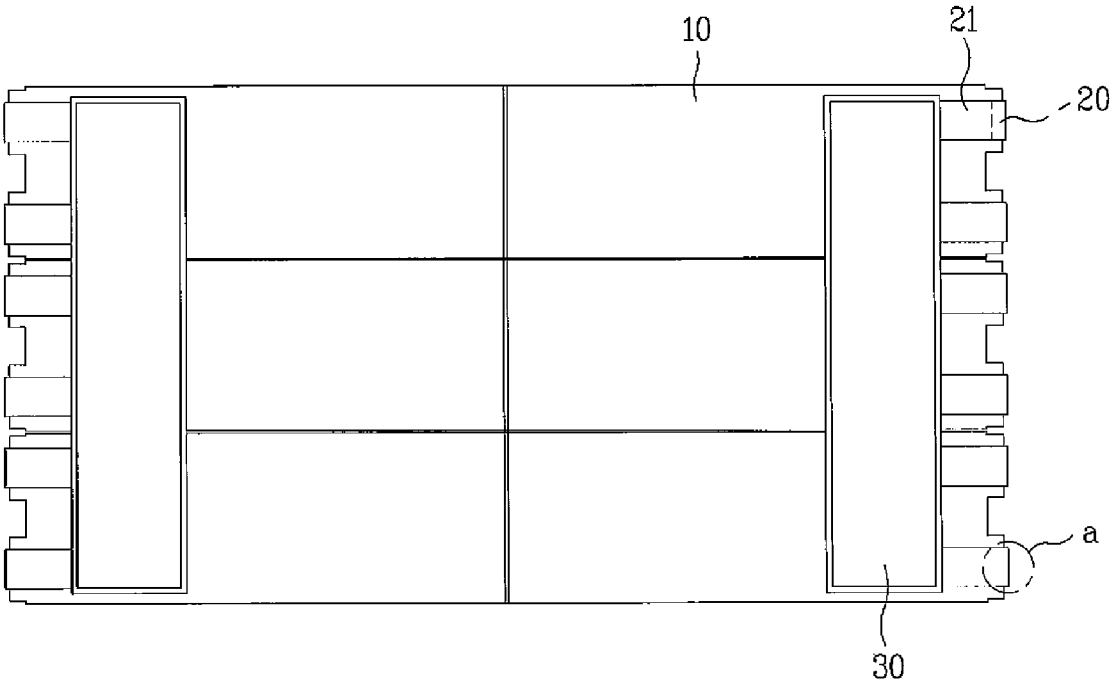


FIG. 3
Related Art

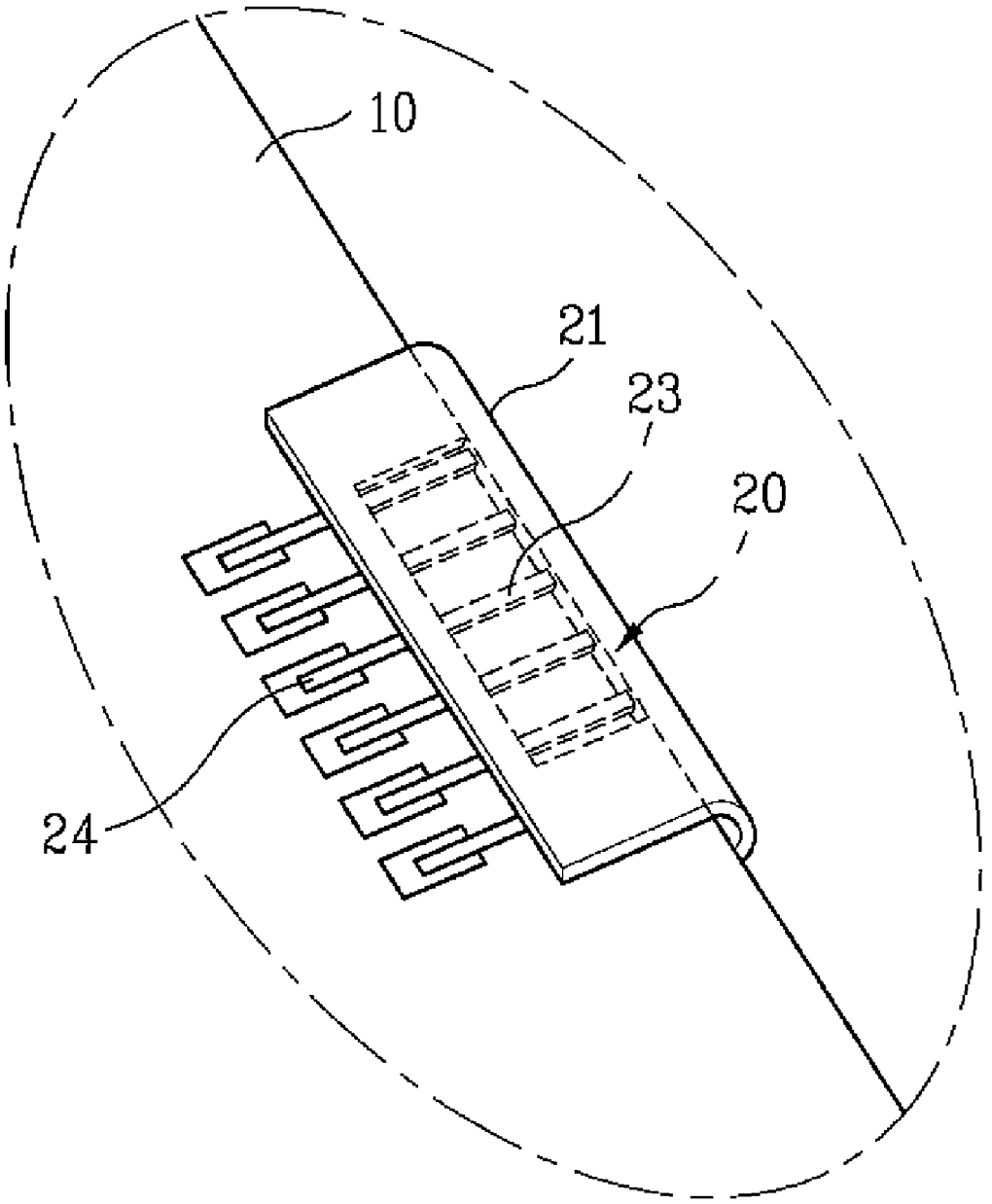


FIG. 4

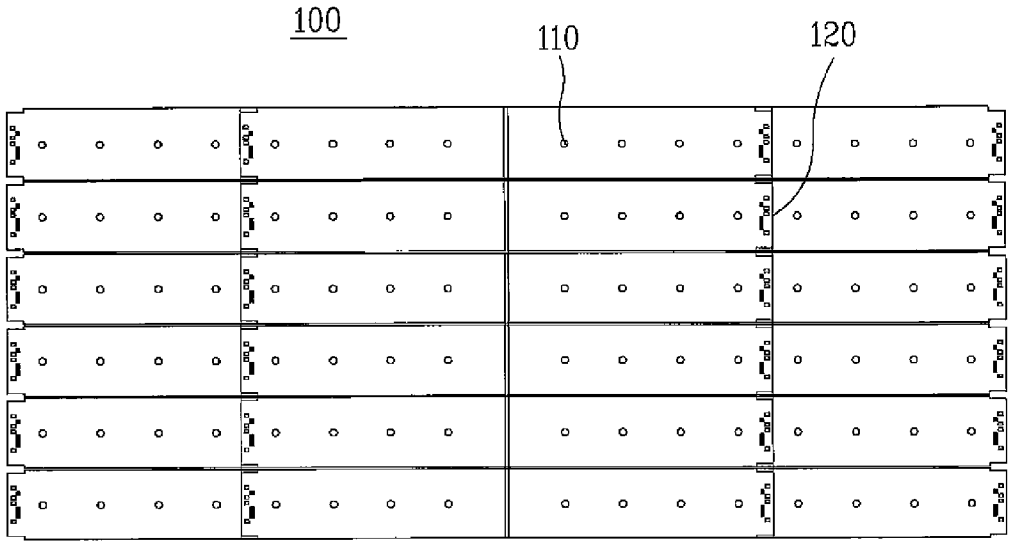


FIG. 5

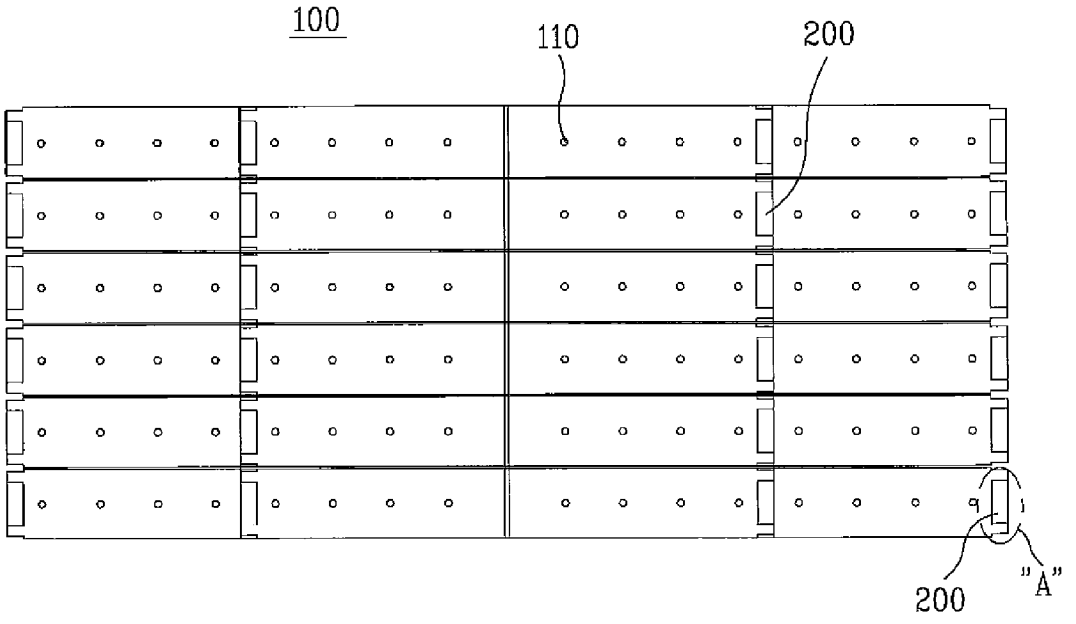


FIG. 6

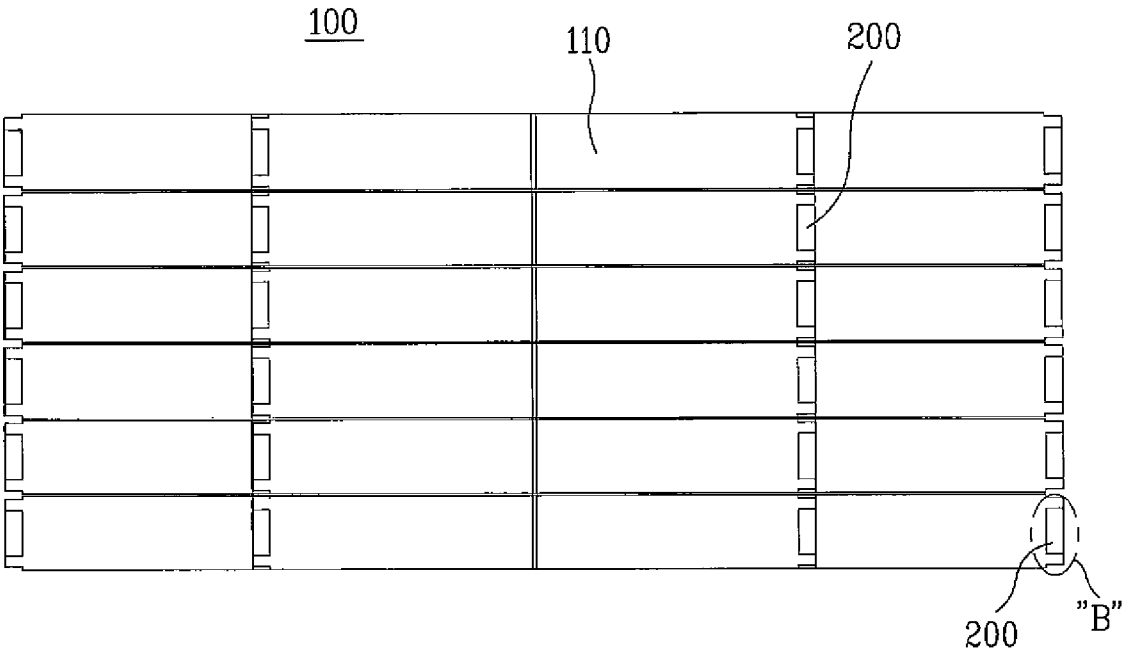


FIG. 7

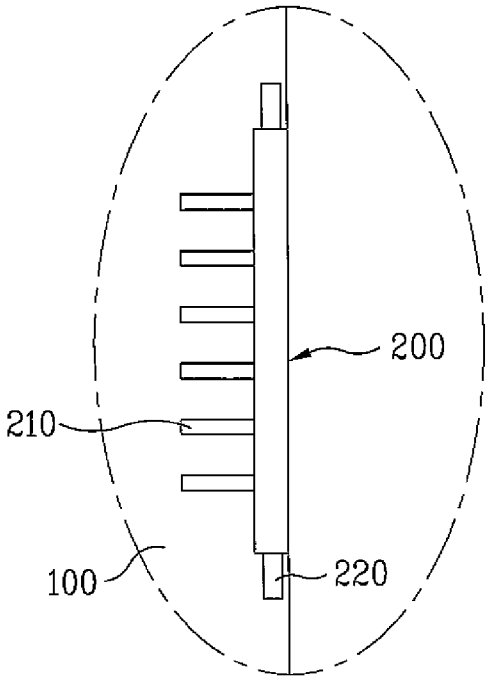


FIG. 8

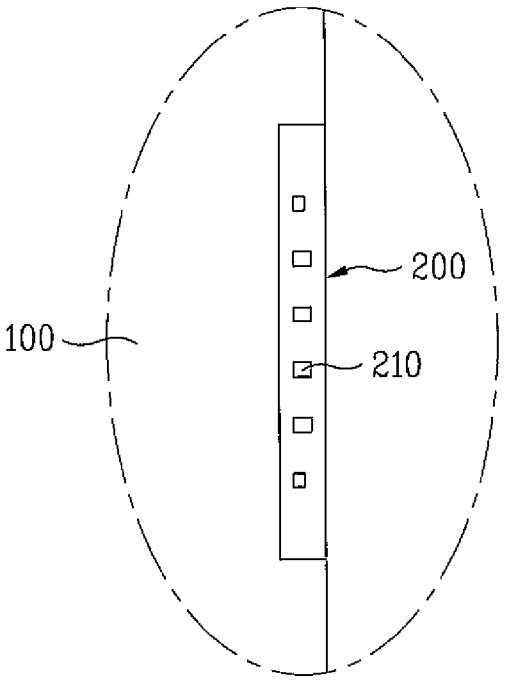


FIG. 9

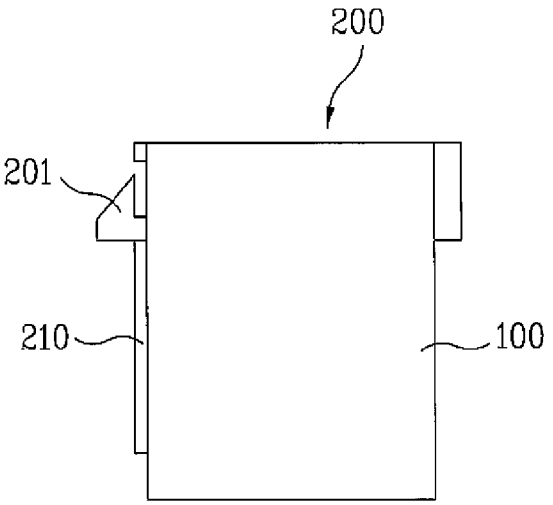


FIG. 10

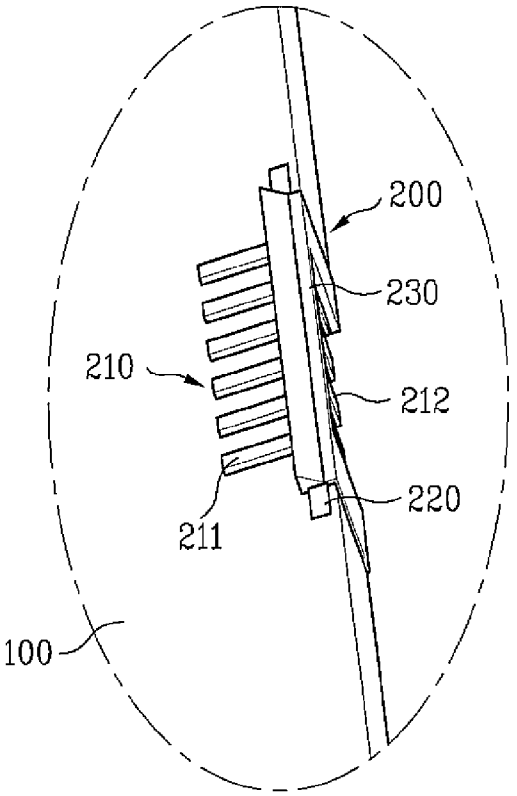


FIG. 11

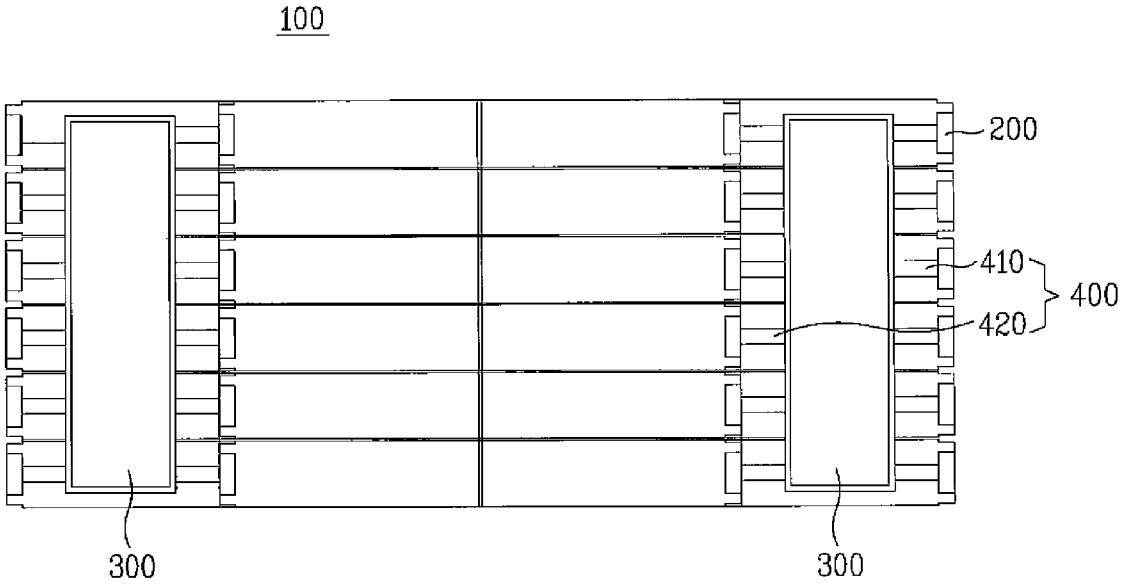
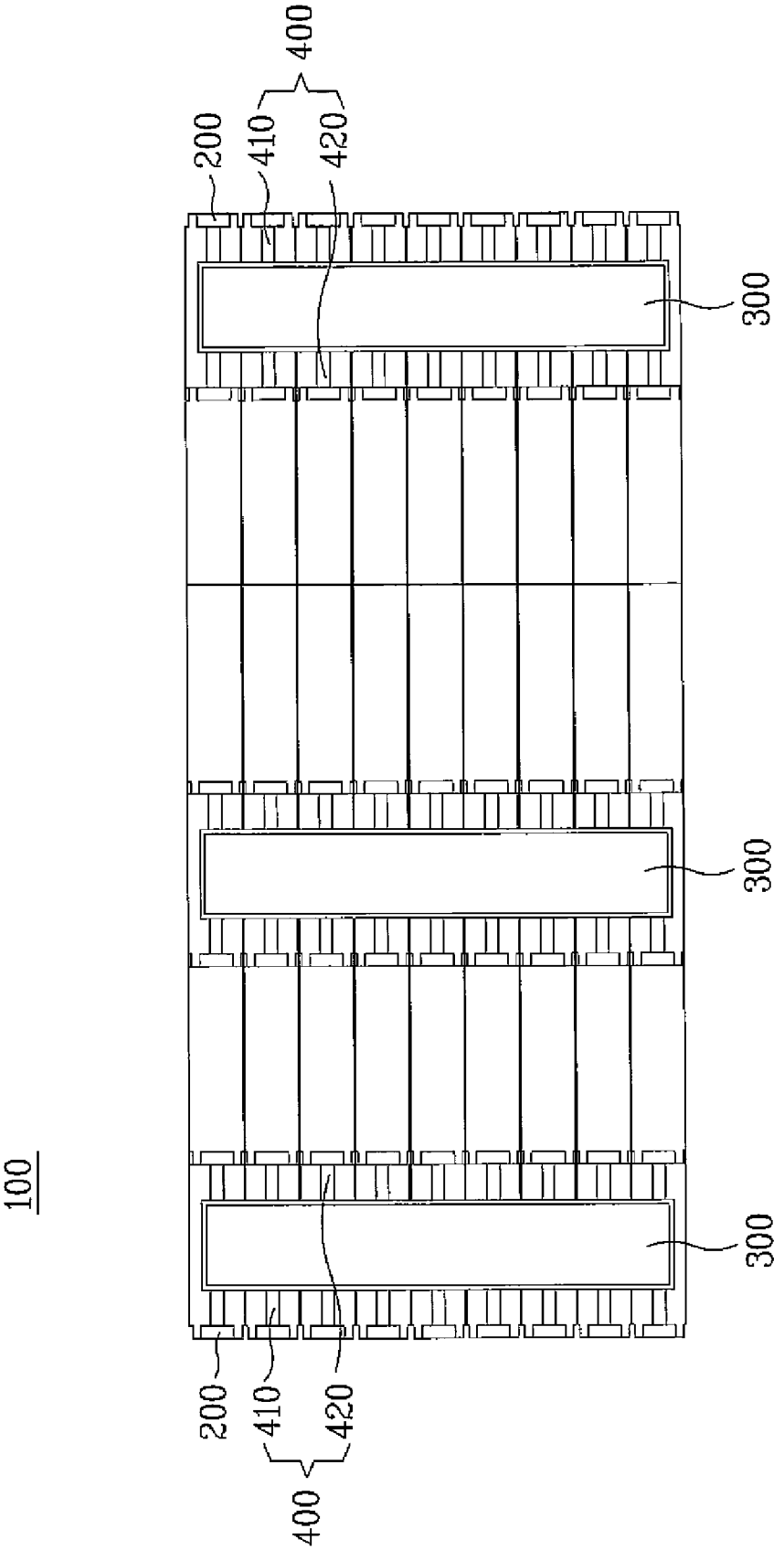


FIG. 12



LIGHTING DEVICE, BACKLIGHT UNIT, AND PRINTED CIRCUIT BOARD THEREOF

CROSS REFERENCE TO RELATED APPLICATION

This application claims the benefit of Korean Patent Application No. 10-2006-0093573, filed on Sep. 26, 2006, which is hereby incorporated by reference as if fully set forth herein.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a lighting device, a backlight unit, and a printed circuit board thereof, and more particularly, to a lighting device, a backlight unit, and a printed circuit board thereof including light emitting elements that can be driven in a sub-divided manner.

2. Discussion of the Related Art

Light emitting diodes (LEDs) are semiconductor light emitting devices that convert current to light so as to emit light. Since a red LED using GaAsP compound semiconductor was commercially available in 1962, it has been used together with a GaP:N-based green LED as a light source in electronic apparatuses for image display.

Further, the wavelength of light emitted from such an LED depends on the semiconductor material used to fabricate the LED, This is because the wavelength of the emitted light depends on the band gap of the semiconductor material representing an energy difference between valence-band electrons and conduction-band electrons.

In addition, a Gallium nitride (GaN) compound semiconductor is used in high-power electronic devices, because it exhibits a high thermal stability and a wide band gap of 0.8 to 6.2 eV. Further, it is possible to fabricate a semiconductor layer capable of emitting green, blue, or white light using GaN in combination with other elements, for example, indium (In), aluminum (Al), etc.

Further, it is possible to fabricate a semiconductor layer capable of emitting green, blue, or white light by combining GaN with other elements, for example, indium (In), aluminum (Al), etc.

Thus, it is possible to adjust the wavelength of light to be emitted by combining GaN with other appropriate elements. Accordingly, when GaN is used, it is possible to appropriately determine the materials of a desired LED in accordance with the characteristics of the apparatus to which the LED is applied. For example, it is possible to fabricate a blue LED useful for optical recording or a white LED to replace a glow lamp.

Because emission of white light is possible, the white light can be used for an illumination purpose. For example, white light can be used for a backlight unit of a liquid crystal display (LCD) device. Further, the LCD device, which is a light reception type flat display, has no ability to emit light by itself. Thus, the LCD device forms an image by using a backlight unit (BLU)

In more detail, a BLU includes a plurality of white LEDs arranged on a substrate such that light emitted from the white LEDs can be uniformly diffused. In more detail, FIG. **1** illustrates front circuit boards of a related art LED backlight unit. As shown in FIG. **1**, six circuit boards **10** are mounted to a front surface of the backlight unit. Each circuit board **10** includes a plurality of mounts **11**, to which LEDs are mounted, respectively, and connecting pads **12** arranged at one end of the circuit board **10**, and electrically connected to the mounts **11**.

In addition, shown in FIG. **1**, the connectors **12** are arranged at opposite lateral ends of the backlight unit, namely, left and right ends of the backlight unit. Further, FIG. **2** illustrates the back surfaces of the circuit boards **10**. As shown in FIG. **2**, each circuit board **10** is connected to a drive board **30** via a connector **20** and connecting lines **21** under the condition in which the circuit board **10** is fixed to the backlight unit.

FIG. **3** illustrates a connected state of the connector **20**. That is, FIG. **3** corresponds to a back surface of a portion "a" in FIG. **2**. As shown in FIG. **3**, each connector **20** includes a connector body **22**, and first and second pins **23** and **24** provided at the connector body **22**. The first pins **23** are connected to respective connecting lines, whereas the second pins **24** are connected to the connector **12** of the associated circuit board **10**. Thus, the connector **20** connects the associated circuit board **10** to the drive board **30**. Each first pin **23** is integral with an associated one of the second pins **24**.

In addition, each connecting line **21** extends along the back surface of the associated circuit board **10**, and is connected to the drive board **30**. Because the circuit boards **10** are densely arranged, the connection of each connecting line to each connector **20** must be achieved only in a direction parallel to the plane of the associated circuit board **10**, as shown in FIG. **3**.

That is, in the related art backlight unit structure, the connectors **20** and connecting lines are arranged only at the left and right ends of the overall structure of the circuit boards **10**, irrespective of the size of the backlight unit.

Therefore, the related art LED backlight unit cannot have a size freely variable in accordance with the size of the used LCD panel. Further, for a backlight unit having a small size, it is sufficient that the connectors are arranged only at one side of the backlight unit. However, for a backlight unit having a large size, there may be problems because the size of the circuit boards must be increased in proportion to the increased size of the backlight unit.

In addition, for an LED backlight unit, LEDs are mounted on circuit boards so that the circuit boards can be assembled to the backlight unit. Therefore, when each circuit board has an increased size, the number of LEDs mounted on the circuit board must be increased.

Meanwhile, the same type of LEDs have differences in terms of wavelength and brightness due to this characteristics. When such differences are increased, an increased color deviation occurs in the backlight unit. In addition for a large-size LED backlight unit using the above-mentioned related art circuit boards, the possibility that the color deviation occurs is increased, because an increased number of LEDs are used for one circuit board. As a result, the backlight unit with an increased size exhibits an increased defect rate.

In addition, for a large-size LED backlight unit using the above-mentioned circuit board, the possibility that the color deviation occurs is increased, because an increased number of LEDS are used for one circuit board. As a result, the backlight unit is manufactured with an increased defect rate.

Furthermore, the increased size of the circuit boards results in an increased size of equipment required for mounting LEDs and other elements on the circuit boards, where the equipment can be, for example, a surface mounting equipment such as a loader, a screen printer, a chip mounter, and a

reflow device. Therefore, the cost of equipment is increased, especially because the prices of most surface mounting equipment are high.

SUMMARY OF THE INVENTION

Accordingly, one object of the present invention is to provide a lighting device, a backlight unit, and a printed circuit board thereof that substantially obviates one or more problems caused by the limitations and disadvantages of the related art.

Another object of the present invention is to provide a lighting device and a backlight unit each including circuit boards subdivided to have a reduced size while being capable of independently driving the circuit boards, and a printed circuit board usable for each circuit board of the lighting device and backlight unit.

To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, the present invention provides in one aspect a backlight unit including a circuit board mounted with light emitting diodes and formed with connecting pads electrically connected with the light emitting diodes, a driver installed on one surface of the circuit board, and configured to drive the light emitting diodes, a connector coupled to the connecting pads of the circuit board, the connector having a connecting direction changed toward the driver, and a connecting line for connecting the connector to the driver.

In another aspect the present invention provides a backlight unit including a circuit board having a first surface on which light emitting diodes are mounted, a second surface on which a driver for driving the light emitting diodes is installed, and connecting pads electrically connected with the light emitting diodes, and a connector coupled to the connecting pads, the connector having a connecting direction changed toward the second surface.

In yet another aspect, the present invention provides a printed circuit board including a connector including a plurality of first pins connected to a circuit of the printed circuit board, and a plurality of second pins extending from the first pins while being bent from the first pins, and a connected line connected to the connector.

In still another aspect, the present invention provides a lighting device including a circuit board having a first surface mounted with light emitting diodes and at least one driver configured to drive the light emitting diodes and connecting pads electrically connected to the light emitting diodes, and a connector coupled to the connecting pads of the circuit board, the connector formed to have a connecting direction toward the first surface of the circuit board.

Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention.

In the drawings:

FIG. **1** is a plane view illustrating front surfaces of circuit boards included in a related art backlight unit;

FIG. **2** is a plane view illustrating back surfaces of the circuit boards of the related art backlight unit;

FIG. **3** is an enlarged perspective view corresponding to a portion "a" of FIG. **2**;

FIG. **4** is a plane view illustrating front surfaces of circuit boards according to and embodiment of the present invention;

FIG. **5** is a plane view illustrating connectors connected to the circuit boards according to an embodiment of the present invention;

FIG. **6** is a plane view illustrating back surfaces of the circuit board according to and embodiment of the present invention;

FIG. **7** is an enlarged view corresponding to a portion "A" of FIG. **5**;

FIG. **8** is an enlarged view corresponding to a portion "B" of FIG. **6**;

FIG. **9** is a side view illustrating the connectors connected to the circuit boards according to an embodiment of the present invention;

FIG. **10** is a perspective view illustrating the connectors connected to the circuit boards according to an embodiment of the present invention; and

FIG. **11** is a plane view illustrating the back surfaces of the circuit board and drivers according to an embodiment of the present invention; and

FIG. **12** is a plane view illustrating back surfaces of circuit boards according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

It will be understood that when an element such as a layer, region or substrate is referred to as being "on" another element, it can be directly on the other element or intervening elements may also be present. Further, it will be understood that, although the terms first, second, etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms.

FIRST EMBODIMENT

Referring to FIG. **4**, a backlight unit according to a first embodiment of the present invention is illustrated. The backlight, unit includes a plurality of base plates or circuit boards **100** arranged in horizontal and vertical directions. Light emitting diodes (LEDs) are mounted on a first surface of the backlight unit. The backlight unit also includes drivers **300** (FIG. **11**) each supported by a second surface.

The first surface may be a front surface of each circuit board **100**, whereas the second surface may be a back surface of each circuit board **100**. Alternatively, the second surface may be an inner or outer surface of an element of the backlight unit which is spaced apart from the circuit boards **105** by a certain distance. For each circuit board **100**, a printed circuit board may be used. Other types of base plates may also be used.

The following description will be given in conjunction with an example in which the first surface is the front surface of each circuit board **100**, and the second surface is the back surface of each circuit board **105**.

As shown in FIG. **4***a* plurality of mounts **110** are formed on the front surface of each circuit board **100**, and a light emitting

diode (LED) is mounted to each mount **110**. The mounts **110** of each circuit board **100** are aligned together horizontally and vertically in this embodiment. Connecting pads **120** are also formed at one lateral end of each circuit board **100**, in order to connect the circuit board **100** to a driver.

When a printed circuit board is used for each circuit board **100**, the circuit board **100** may include connecting portions (not shown), to which the LEDs of the mounts **110** are coupled, and printed lines connecting the connecting portions to the connecting pads **120**.

As shown in FIG. **5**, a connector **200** is also coupled to the connecting pads **120** of each circuit board **100**. The connection direction of the connector **200** may be changed from a horizontal direction to a vertical direction. Accordingly, the connector **200** can be connected to the associated driver **300** (FIG. **11**) in a direction other than the direction parallel to the plane of the associated circuit board **100**.

That is, the connector **200** has one end extending in a direction parallel to the plane of the circuit board **100** at the front side of the circuit board **100**, and the other end extending in a direction perpendicular to the plane of the circuit board **100** such that the other end is connectable to the back side of the circuit board **100**. Accordingly, the connector **200** can more easily connect the circuit board **100** to the driver.

Thus, the connectors **200** can be coupled to all circuit boards **100** in a circuit board arrangement including more than two columns of circuit boards **100**. That is, the connectors **200** can be coupled not only to the leftmost and rightmost circuit boards **100** in the circuit board arrangement, but also to the inner circuit boards **100** in the circuit board arrangement.

FIG. **6** illustrates the back surfaces of the circuit boards **100**. A driver **300** (FIG. **11**) is connected to the back surfaces of the associated circuit boards **100** by connecting lines **400** (FIG. **11**). Because each connector **200** has a connecting portion extending in a perpendicular direction to the plane of the circuit board **100**, the connectors **200** can be more easily coupled to the connecting lines, and thus to the driver **300**.

That is, because the connecting portion of each connector **200** is exposed when viewing the back side of the associated circuit board **100**, as shown in FIG. **6**, it is possible to directly connect the connecting lines **400** to the connector **200** without changing the connection direction of the connecting lines **400** or without using any separate tool (FIG. **8**). Accordingly, the arrangement of the circuit boards **100** is not restricted by the arrangement of the connectors **200** or the connection positions of the connecting lines **400**.

FIGS. **7** to **10** illustrate a detailed structure of each connector **200**. In more detail, and as shown in FIG. **10**, each connector **200** includes a connector body **230**, and a plurality of connecting pins **210** provided at the connector body **230**. The connector **200** is also coupled to a lead **220** (see FIG. **7**).

Further, FIG. **7** is an enlarged view corresponding to a portion "A" of FIG. **5**, whereas FIG. **8** is an enlarged view corresponding to a portion "B" of FIG. **6**. Further, the connecting pins **210** shown in FIG. **7** are adapted to be in contact with the connecting pads **120** of the circuit board **100**. The connecting pins **210** shown in FIG. **8** are adapted to be coupled to the connecting lines **400** connected to the driver **300** as shown in FIG. **11**.

As shown in FIG. **10**, the connecting pins **210** of the connector **200** include first pins **211** adapted to be connected to the connecting pad **210** of the circuit board **100**, and second pins **212** extending toward the back surface of the circuit board **100** while being bent with respect to the first pins **211**. Further, it is preferable that the second pins **212** are bent from the first pins by about 90°.

The first pins **211** and second pins **212** may be made of a conductive material, and may be formed such that one first pin **212** and one second pin **212** have an integral and bent structure. The connecting pins **210**, which have such a structure, are coupled to the connector body **230** such that they extend in parallel. Further, each connecting pin **210** is bent in a direction perpendicular to the plane of the circuit board **100**.

In this structure, each connector **200** can be connected to the driver **300** by connecting the connecting lines **400** (FIG. **11**) to the vertically-bent portions of the connecting pins **210**, respectively. In addition, because the connecting pins **210** of each connector **200** are bent toward the back surface of the associated circuit board **100**, it is possible to connect the connector **200** to the driver **300** while securing the circuit boards **100** of the backlight unit to be densely arranged. Accordingly, it is possible to arrange the circuit boards **100** in various arrangements even when the size of each circuit board **100** is small.

Next, FIG. **9** is a side view illustrating a coupled state of each connector **200** to the associated circuit board **100**. As shown the connector **200** includes a fastener **201** adapted to firmly couple the connector **200** to the circuit board **100** or to a case of the backlight unit. As shown in FIG. **11**, the connecting lines **400** are connected to the vertically-bent portion of the connector **200** coupled to each circuit board **100**. The connecting lines **400** are also connected to the driver **300** adapted to drive the LEDs mounted to the circuit board **100**.

In more detail, FIG. **11** illustrates the back surfaces of the circuit boards **100**. As shown in FIG. **11**, connecting lines **410** and **420** are connected to each driver **300** at opposite sides of the driver **300**. Thus, the circuit boards **100** can be connected to each driver **300** at the opposite sides of the driver **300** by the connecting lines **400** so that the circuit boards **100** can be driven by the driver **300**.

In FIG. **11**, the circuit boards **100** in the left two circuit board columns can be connected to and driven by the left driver **300**, whereas the circuit boards **100** in the right two circuit board columns can be connected to and driven by the right driver **300**. That is, one-side ones of the circuit boards **100** in two circuit board columns to be connected to the same driver **300** are connected to one side of the driver **300** by the first connecting lines **410**, whereas the other-side ones of the circuit boards **100** are connected to the other side of the driver **300** by the second connecting lines **410**. In addition, each driver **300** can be configured to have separate structures for respective circuits **100**. However, it is preferred the driver **300** have an integrated structure, as shown in FIG. **11**.

As described above, LEDs are mounted to the front surfaces of the multiple circuit boards **100** which are arranged in horizontal and vertical directions. Also, the drivers **400** are connected to the circuit boards **100** by the connectors **200** and connecting lines **400**. The circuit boards **100** are also arranged in the backlight unit case. Further, diffusion plates or diffusion lenses may be arranged over the circuit boards **100**, in order to uniformly diffuse light emitted from the LEDs.

SECOND EMBODIMENT

The circuit boards **100** can also be arranged in 4 or more columns. For example, FIG. **12** illustrates a 6-column arrangement of circuit boards **100**. Further, the connectors **200** are coupled to respective circuit boards **100** such that the connector **200** associated with each circuit board **100** in a first column, a second column, a third column, and a fourth column is arranged at the left side of the associated circuit board **100**, and the connector **200** associated with each circuit board **100** in a fifth column and a sixth column is arranged at the

right side of the associated circuit board **100**. Each connector **200** is connected to the driver **300** by the connecting lines **400**. The position of each connector **200** may be changed.

As shown in FIG. **12**, one-side of the circuit boards **100** in two circuit board columns to be connected to the same driver **300** is connected to one side of the driver **300** by first connecting lines **410**, whereas the other-sides of the circuit boards **100** are connected to the other side of the driver **300** by second connecting lines **410**.

The connectors **200** may have the same structure as that of the connectors **200** shown in FIGS. **7** to **10**. That is, each connector **200** has a first connecting portion connected to connecting pads **120** of the associated circuit board **100** at one side of the connector **200**, and a second connecting portion bent with respect to the first connecting portion by a certain angle such that the connection direction of the connector **200** is changed toward the back side of the circuit board **100**. Accordingly, the connector **200** can be connected with the connecting lines **400** at the back side of the circuit board **100**.

As described above, in accordance with the present invention, the circuit boards **100** can be arranged in a plurality of columns. FIG. **11** illustrates a plurality of circuit boards **100** are arranged in 4 columns and in 6 rows, and FIG. **12** illustrates a plurality of circuit boards **100** arranged in 6 columns and in 9 rows.

That is, in accordance with an embodiment the present invention, it is possible to sub-divide the circuit boards **100** such that the circuit boards **100** have a reduced size and are arranged in an increased number of columns, 2 rows or more. Also, the circuit boards **100** can be arranged in odd columns, for example, 3 columns or 5 columns.

In addition, when the circuit boards **100** are sub-divided to have a reduced size, it is possible to implement a chip-on-board type structure or a direct molding type structure, because the unit size of the circuit boards **100** in the overall circuit board structure is small.

As apparent from the above description, the backlight unit according to the present invention has several advantages.

That is, in the related art backlight unit, only a two-column arrangement is possible, because the connection of each connecting line to each connector must be achieved only in a direction parallel to the plane of the associated circuit board (FIG. **2**). In accordance with embodiments of the present invention, however, the circuit boards **100** can be sub-divided such that the circuit boards **100** have a reduced size, and the drivers **300** of the same number as that of the circuit boards **100** can be arranged to drive the sub-divided circuit boards **100**, respectively.

Further, when the circuit boards **100** are driven under a sub-divided condition as described above, it is possible to greatly reduce the power consumption during the operation of the backlight unit. This is because it is possible to drive only the circuit boards **100** corresponding to portions of a display screen to be brightly displayed, without driving the circuit boards **100** corresponding to dark portions of the display screen, in spite of image signals received by the latter circuit boards **100**, or while supplying only a micro current to the latter circuit boards **100**.

In the circuit board structure of the related art backlight unit, it is impossible to reduce the size of each circuit board to a certain size. Thus, all circuit boards are always driven at the same brightness. As a result, the power consumption of the related art backlight unit is very high.

In accordance with embodiments of the present invention, however, there is an advantage because it is possible to effectively reduce the rate of defects of LEDs caused by color deviation or process errors, because the size of each circuit board **100**, which is independently driven, is small. Because the size of each circuit board **100** is small, it is possible to manufacture the backlight unit using the existing surface mounting equipment without using separate large-scale surface mounting equipment. Thus, there are many advantages according to the reduced size of the circuit boards **100**.

In addition, because the circuit boards **100** can be independently driven in a sub-divided state, it is possible to realize a stereoscopic display screen. Also, this effect results in a reduction in the power consumption of the backlight unit.

It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A backlight unit, comprising:

a circuit board mounted with light emitting diodes, and formed with connecting pads electrically connected with the light emitting diodes;

a driver installed on one surface of the circuit board, and configured to drive the light emitting diodes;

a connector coupled to the connecting pads of the circuit board, the connector having a connecting direction changed toward the driver; and

a connecting line for connecting the connector to the driver.

2. The backlight unit according to claim **1**, wherein the driver is installed on a first second surface opposite to a surface of the circuit board on which the light emitting diodes are mounted.

3. The backlight unit according to claim **1**, wherein the connector comprises an angular connector.

4. The backlight unit according to claim **3**, wherein the connector further comprises:

a plurality of first pins connected to the connecting pads of the circuit board; and

a plurality of second pins extending from the first pins while being bent from the first pins toward a back side of the circuit board.

5. The backlight unit according to claim **4**, wherein the connector further comprises:

a connector body to which the first pins and the second pins are fixed.

6. The backlight unit according to claim **4**, wherein the second pins are bent from the first pins by about 90°.

7. The backlight unit according to claim **4**, wherein the first pins and the second pins are integrally formed.

8. The backlight unit according to claim **1**, wherein the connector is coupled to a lead formed at the circuit board.

9. The backlight unit according to claim **1**, wherein the circuit board comprises a plurality of circuit boards arranged in at least two columns.

10. The backlight unit according to claim **9**, wherein the connecting line comprises connecting lines connected to the driver at different portions of the driver.

11. The backlight unit according to claim **10**, wherein the connecting lines further comprises:

first connecting lines for connecting a first column of the circuit boards to one side of the driver; and

second connecting lines for connecting a second column of the circuit boards adjacent to the first column of the circuit boards to the other side of the driver.

12. The backlight unit according to claim **1**, wherein the circuit board comprises sub-divided circuit boards respectively driven by a corresponding driver.

13. A backlight unit, comprising:

a circuit board having a first surface on which light emitting diodes are mounted, a second surface on which a driver for driving the light emitting diodes is installed, and connecting pads electrically connected with the light emitting diodes; and

a connector coupled to the connecting pads, the connector having a connecting direction changed toward the second surface of the circuit board.

14. The backlight unit according to claim 13, wherein the connector further comprises:

a plurality of first pins connected to the connecting pads of the circuit board; and

a plurality of second pins extending from the first pins while being bent from the first pins toward the second surface of the circuit board.

15. The backlight unit according to claim 13, wherein the connector further comprises:

a connecting line for connecting the connector to the driver.

16. The backlight unit according to claim 13, wherein the circuit board comprises at least two columns of circuit boards connected to the driver.

17. The backlight unit according to claim 13, wherein the connector includes connecting pins extending toward the second surface.

18. A printed circuit board, comprising:

a connector including a plurality of first pins connected to a circuit of the printed circuit board, and a plurality of second pins extending from the first pins while being bent from the first pins; and

a connecting line connected to the connector, wherein a plurality of light emitting diodes are bonded to the printed circuit board.

19. The printed circuit board according to claim 18, wherein the second pins of the connector are bent from the first pins by about 90°.

20. A lighting device, comprising:

a circuit board having a first surface mounted with light emitting diodes, at least one driver configured to drive the light emitting diodes, and connecting pads electrically connected to the light emitting diodes; and

a connector coupled to the connecting pads of the circuit board, the connector having a connecting direction changed toward the first surface of the circuit board.

21. The lighting device according to claim 20, wherein the connector further comprises:

a plurality of first pins connected to the connecting pads of the circuit board; and

a plurality of second pins extending from the first pins while being bent from the first pins toward the second surface of the circuit board.

22. The lighting device according to claim 20, further comprising:

a connecting line for connecting the connector to the driver.

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